DEPARTMENT OF KAUMARBHRITYA

CSMSS AYURVED COLLEGE AURANGBAD

NEONATAL SEIZURES

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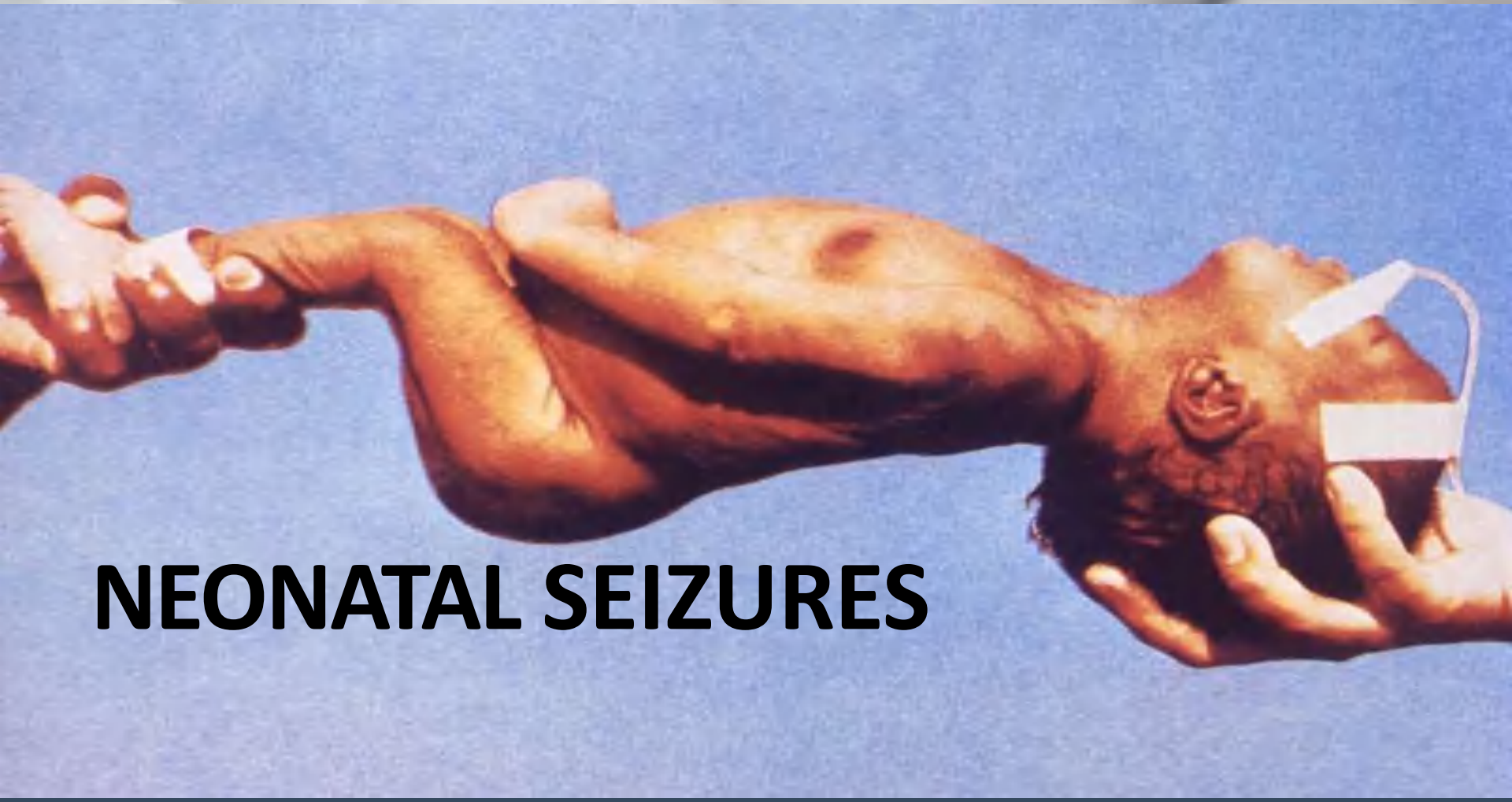


NEONATAL SEIZURES

Definition

- A stereotypic, paroxysmal spell of altered neurologic function

  (behavior, motor, and/or autonomic function)
- Neonatal period limited to :

  - first 28 days for term infants

  - 44 weeks gestational age for pre-term
- First sign of neurological dysfunction
- Powerful predictors of long-term cognitive and developmental impairment

Frequency

- Incidence of seizures higher in the neonatal period than in any other age group

Why do neonatal seizures have such unusual presentations?

- Immature CNS cannot sustain a synchronized, well orchestrated generalized seizure

Epidemiology

- **Race:** No racial preponderance.
- **Sex: No** Sex-based differences
- **Age:**
- first 4 weeks of life in a full-term infant -44 weeks from conception for premature infants.
- most frequent during the first 10 days of life.

Classification

I. Clinical Seizure

- Subtle
- Tonic
- Clonic
- Myoclonic

Classification

II. Electroencephalographic seizure

- Epileptic
- Non-epileptic

Clinical Classification

1. Subtle

Most common subtype

- More in preterm than in term
- Eye deviation (term)
- Blinking, fixed stare (preterm)
- Repetitive mouth and tongue movements
- Apnea
- Pedaling and tonic posturing of limbs

Clinical Classification

2. Tonic

- Primarily in Preterm
- May be focal or generalized
- Sustained periods of muscle contraction
- Sustained extension of the upper and lower limbs (mimics decerebrate posturing)
- Sustained flexion of upper with extension of lower limbs (mimics decorticate posturing)
- Signals severe ICH in preterm infants
- Generally poor prognosis

Clinical Classification

3. Clonic

- Primarily in term
- Focal or multifocal
- Biphasic –Fast contraction, Slow relaxation
- Clonic limb movements(synchronous or asynchronous, localized or often with no anatomic order of progression)
- Consciousness may be preserved
- Signals focal cerebral injury

Clinical Classification

4. Myoclonic

- Rare
- Focal, multifocal or generalized
- Lightning fast contractions-like jerks of extremities (upper > lower)

  Signify diffuse –serious brain injury

Electroencephalographic seizure

I. Epileptic

- Consistently associated with electro-cortical seizure activity on the EEG
- Cannot be provoked by tactile stimulation
- Cannot be suppressed by restraint of involved limb or repositioning of the infant
- Related to hyper synchronous discharges of a critical mass of neuron

Electroencephalographic seizures

II. Non-epileptic

- No electro-cortical signature
- Provoked by stimulation
- Suppressed by restraint or repositioning
- Brainstem release phenomena (reflex)

SEIZURE MIMICS

- Jitteriness
- Apnoea
- Benign neonatal sleep myoclonus

APNOEA

- Epileptic
- Lasts <10-20 sec
- Tachycardia
- monorrhythmic

- Nonepileptic
- >10-20 sec
- Bradycardia
- No EEG signs

Benign neonatal sleep myoclonus

- Nonepileptic form of myoclonus
- 1 wk of life
- Resolves spont. Over weeks or months
- A/E- Transient dysmaturity of brainstem reticular activating system
- Movement abolished by arousal
- Never occur in awake state
- No EEG findings

Etiology

- It is critical to recognize neonatal seizures, to determine their etiology, and to treat them for three major reasons:

1. Seizures are usually related to significant illness, sometimes requiring specific therapy

Etiology

2. Neonatal seizures may interfere with important supportive measures, such as alimentation and assisted respirations for associated disorders.

3. Experimental data give some reason for concern that under certain circumstances the seizure per se may be a cause of brain injury.

Etiology

- Clinical history provides important clue
- Family history may suggest genetic syndrome
- Many of these syndromes are benign
- In the absence of other etiologies, family history of seizures may suggest good prognosis

Etiology

- Pregnancy history is important
- Search for history that supports TORCH infections
- History of fetal distress, preeclampsia or maternal infections

Etiology

- Delivery history
- Type of delivery and antecedent events
- Apgar scores offer some guidance
- Low Apgar score without the need for resuscitation and subsequent neonatal intensive care is unlikely to be associated with neonatal seizures

Etiology

- Postnatal history
- Neonatal seizures in infants without uneventful antenatal history and delivery may result from postnatal cause
- Tremulousness may be secondary to drug withdrawal or hypocalcemia
- Temperature and blood pressure instability may suggest infection

First 24 hours

- Hypoxic-ischemic encephalopathy
- CNS & Intrauterine Infections + sepsis
- Drug withdrawal
- Vascular
- Birth trauma
- Pyridoxine dependency
- Inadvertent local anesthetic toxicity

Hours: 24 to 72

- Cerebral dysgenesis
- Vascular
- Metabolic
- Urea cycle disorders
- Drug withdrawal
- Pyridoxine dependency
- Incontinentia pigmenti
- Tuberous sclerosis

72 hours to 1 week

1. Familial neonatal seizures
2. Cerebral malformations
3. Cerebral infarction
4. Hypoparathyroidism (hypocalcemia)
5. Vascular events (venous thrombosis, hemorrhage)
6. Kernicterus (*bilirubin encephalopathy*)
7. Acidurias (methylmalonic acidemia, propionic acidemia)
8. Urea cycle disorders
9. Tuberous sclerosis

Benign familial neonatal seizures

- Autosomal dominant
- No obivious risk factors
- 2nd or 3rd day of life, recur for days or weeks
- Ictal EEG : sudden brief period of generalized voltage attenuation
- C/F: apnoea, tachycardia and tonic posturing
- No antiepileptic treatment required

Benign idiopathic neonatal seizures

- Normal neonatal course
- Birth after 39 weeks
- Seizure on day 4 to 6
- Normal neurological state
- clonic posturing
- Normal EEG

Laboratory Studies to Evaluate Neonatal Seizures

Indicated

Complete blood count, differential, platelet count; urinalysis

Blood glucose (Dextrostix), BUN, Ca, P, Mg, electrolytes

Blood oxygen and acid-base analysis

Blood, CSF and other bacterial cultures

CSF analysis

EEG

EEG

- EEG seizure-repetitive series of electrical discharges that evolves in frequency, amplitude
- Normal rhythmic EEG pattern --Age specific
- EEG seizure is less common before 34 weeks
- Frequency increases with increasing maturity
- Unlike older children neonatal interictal
- EEG can’t predict risk of future seizures

Laboratory Studies to Evaluate Neonatal Seizures

Clinical Suspicion of Specific Disease

Serum immunoglobulins, TORCH antibody titers, and viral cultures

Blood and urine metabolic studies (bilirubin,ammonia, lactate, $FECl^3$, reducing substance.)

Blood and urine toxic screen

Blood and urine amino and organic acid screen

CT or ultrasound scan

Treatment

- Identify the underlying cause:
  hypoglycemia - D10 solution
  hypocalcemia - Calcium gluconate
  hypomagnesemia- Magnesium sulfate
  pyridoxine deficiency- Pyridoxine
  meningitis- initiation of antibiotics

Treatment

- To minimize brain damage
- Some controversy when to start anticonvulsants
- If seizure is prolonged (longer than 3 minutes), frequent or associated with cardiorespiratory disturbance

Drugs	Dose	Adverse Effects	Comments
Phenobarbitone	**20 mg/kg** **max 40mg/kg** **3-5mg/kg/d Q12 hr**	**Hypotension, resp. depression** **arrythmias**	Therapeutic level 15-30 microgram
Phenytoin	15-20 mg/kg (<1mg/kg/min) Mainte 4-8 mg/kg/day q12hr	cardiovascular collapse, arrhythmias, hypotension	10-20micrgms/ml Admin as infusion, Don't mix with dextrose
Benzodiazepines			
1] diazepam	0.1-0.3 mg/kg then 0.3 mg/kg/hr	Cardiac arrest, hypotension, cardiovascular collapse	Short duration, narrow index, sodium benzoate is used at preservative
2]midazolam	0.15 mg/kg then 0.1-0.4 mg/kg/hr	Apnoea, cardiac and respiratory arrest	Faster acting
Lorazepam	0.05 mg/kg stat over 2-5 min	Respiratory arrest, myclonus in LBW	Longer duration, wider index

Acute therapy of neonatal seizures

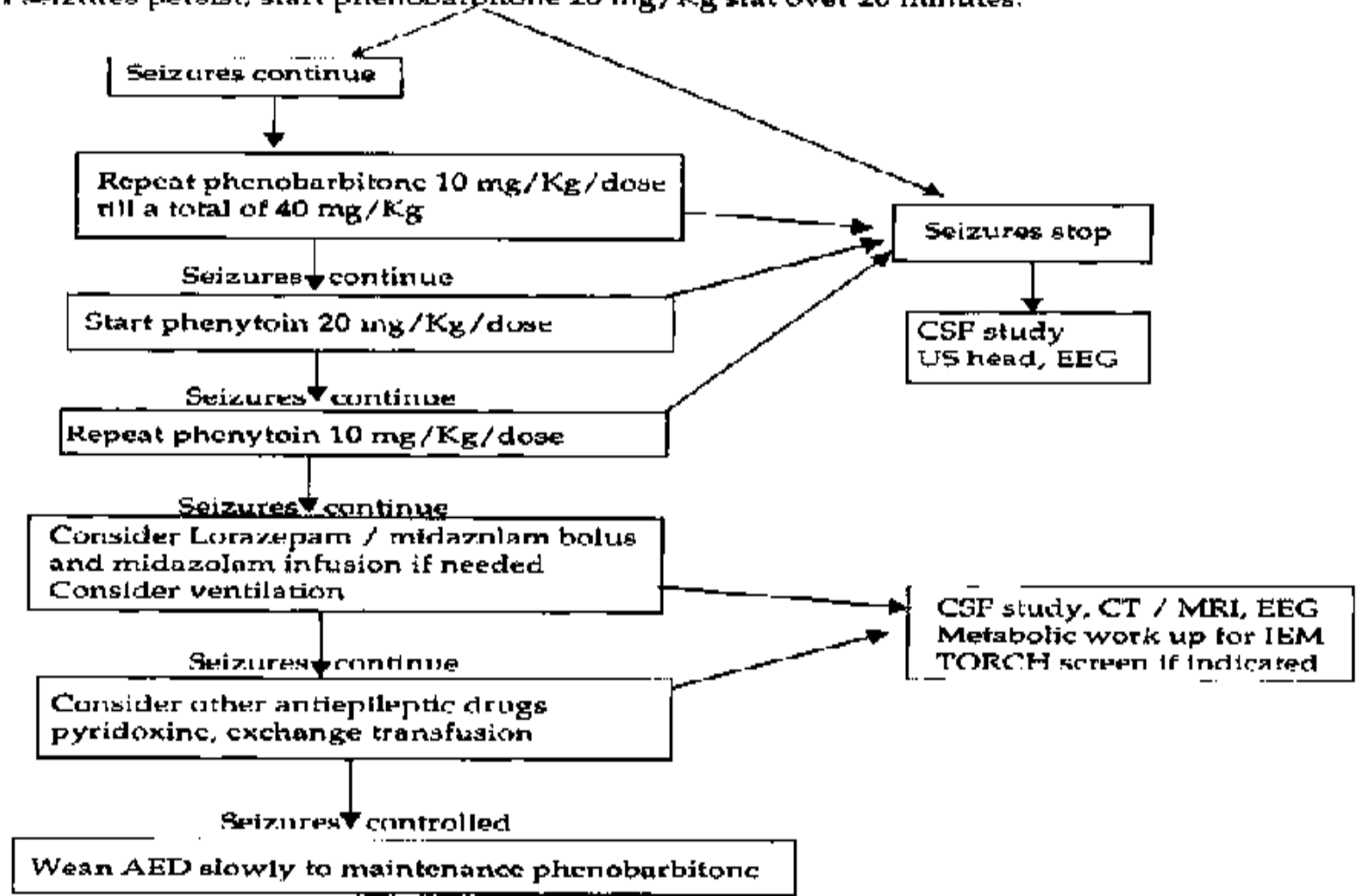
- If with hypoglycemia- Glucose 10%: 2ml/k IV
- If no hypoglycemia- Phenobarbital:20mg/k IV loading dose

  If necessary : additional phenobarbital:
  5 mg/kg IV to a max of 20 mg/kg
  (consider omission of this additional Phenobarbital
  if with baby is asphyxiated)
  Phenytoin: 20 mg/kg, IV (1 mg/kg/min)
  Lorazepam:0.05-0.10 mg/kg, IV

Flow diagram on management of neonatal seizures

Neonate with seizures:

- Identify and characterize the seizure
- Secure airway, and optimize breathing, circulation and temperature
- Start O_2 if seizures are continuous
- Secure IV access and take samples for baseline investigations including sugar, calcium, magnesium, sodium, potassium, arterial blood gas, hematocrit, sepsis screen
- If hypoglycemic (blood sugar<40 mg/dl): 2ml/Kg of 10% dextrose should be given immediately. (For further management see hypoglycemia protocol),
- If blood sugar is in normal range, sample for ionized calcium should be withdrawn and 2 ml/Kg of calcium gluconate (10%) should be given IV under cardiac monitoring
- Brief history and quick clinical examination
- If seizures persist, start phenobarbitone 20 mg/Kg stat over 20 minutes.



Determinants of Duration of anticonvulsant therapy for neonatal seizures

- Neonatal neurological examination
- Cause of neonatal seizure
- Electroencephalogram

WHEN TO DO EEG?

- As soon as a seizure occurs
- Within 24 hours
- Continuous EEG monitoring
- Interictal EEG normal –nonepileptic process
- EEG abnormal-video EEG monitoring
- Repeat EEG at 1 wk duration

Duration of anticonvulsant therapy-Guidelines

Neonatal period

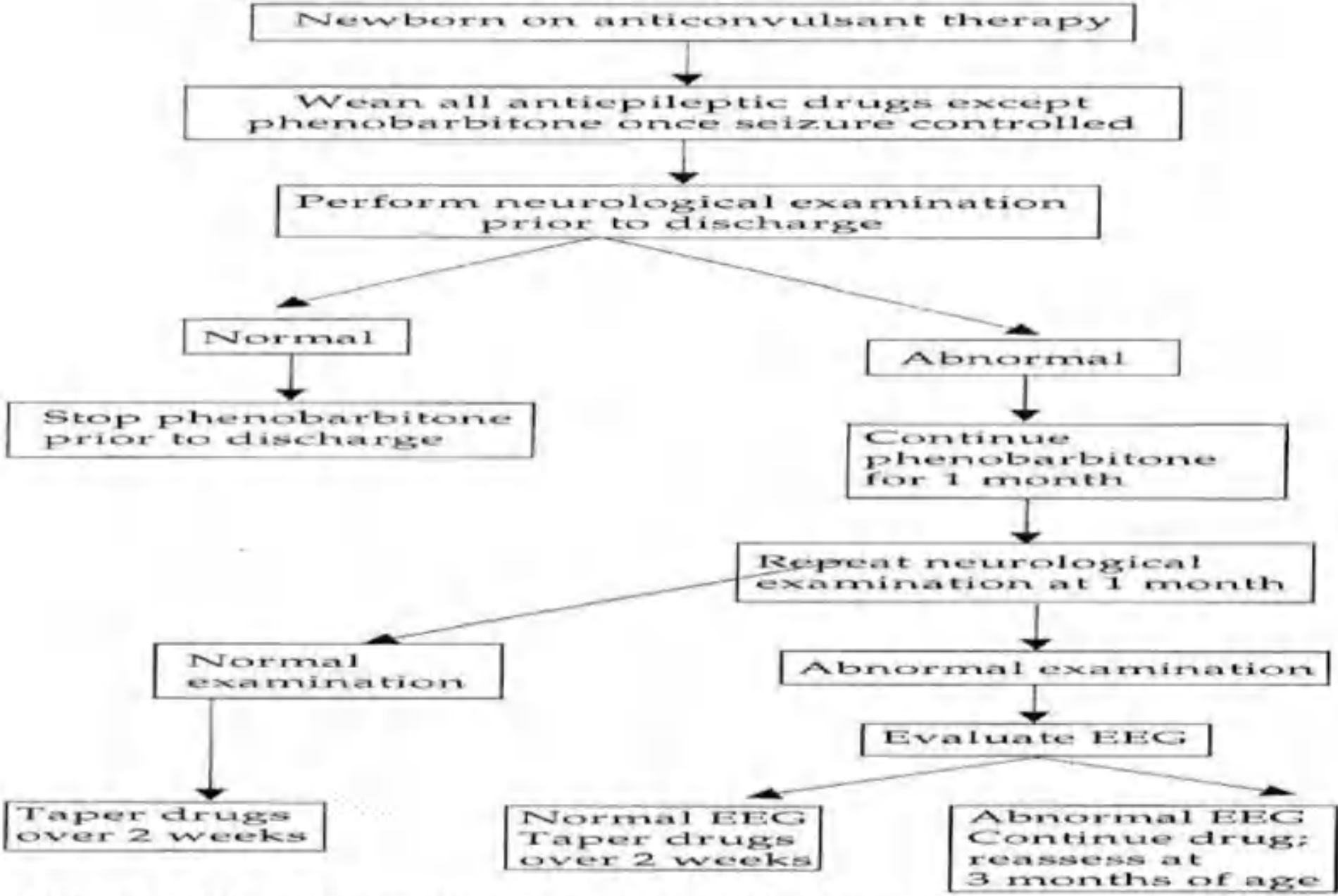
- If neonatal neurological examination becomes normal discontinue therapy
- If neonatal neurological examination is persistently abnormal,consider etiology and obtain EEG
- In most such cases- Continue phenobarbital
  - Discontinue phenytoin
  - Reevaluate in 1 month

Duration of anticonvulsant therapy-Guidelines

<u>One month after discharge</u>

- If neurological examination has become normal, discontinue phenobarbital
- If neurological examination is persistently abnormal,obtain EEG
- If no seizure activity on EEG, discontinue phenobarbital

Flow diagram on weaning and duration of anticonvulsant therapy



·Intractable seizures may need lifelong therapy; consider switching over to other drugs (phenytoin or carbamazepine)

Prognosis

Two most useful approaches in utilizing outcome

- EEG
- Recognition of the underlying neurological disease

Prognosis of Neonatal seizures in relation to EEG

EEG	NEURO.SEQUELE
BACKGROUND	
Normal	≤10
Severe abnormalities†	≥90
Moderate abnormalities‡	**~50**

Causes of Neonatal Seizures and Outcomes

Cause	Percent of Patients Who Have Normal Development
Hypoxic-ischemic encephalopathy	50
Intraventricular hemorrhage	10
Subarachnoid hemorrhage	90
Hypocalcemia	
Early-onset	50
Later-onset	100
Hypoglycemia	50
Bacterial meningitis	50
Developmental malformations	0
Benign familial neonatal convulsions	~100
Fifth-day fits	~100

Complications

- Cerebral palsy
- Hydrocephalus
- Epilepsy
- Spasticity
- Feeding difficulties

Consultations

- Neurology consult needed for
  - evaluation of seizures
  - evaluation of EEG and video EEG monitoring
  - management of anticonvulsant medications

Further Outpatient Care

- Developmental evaluation for early identification of physical or cognitive deficits
- Orthopedic evaluations if with joint deformities
- Consider physical medicine/physical therapy referral if indicated

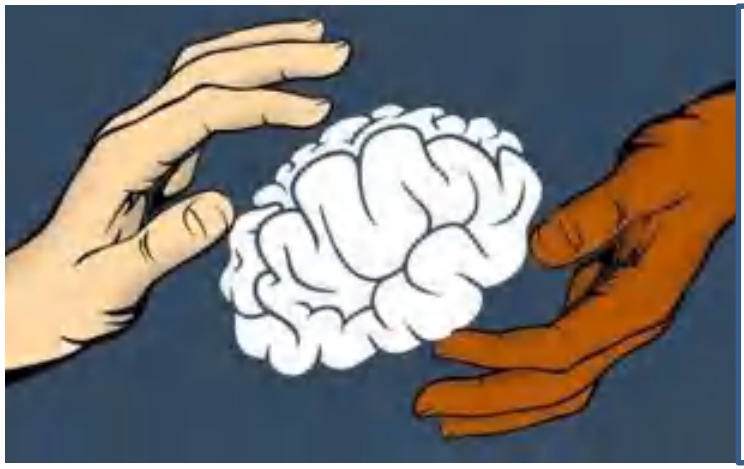
About Dr. Amit Vatkar

Dr. Amit Vatkar is a Pediatric Neurologist from Mumbai, India. He has completed his fellowship in Pediatric Neurology with specialising in Epilepsy surgery workup from Hinduja hospital under the guidance of Vrajesh Udani, top neurologist in India. He has also been trained in Epilepsy & neurophysiology at Case Western Reserve University at Cleveland under the guidance of Dr. Hans Luders.

He specialises in Clinical Neurophysiology (EEG, EMG and NCV). He also provides portable EEG services in Mumbai.

Currently, He is supporting many schools for children with special needs. He is attached to major hospitals in Mumbai where he consults pediatric neurological cases. His areas of expertise are

1. Epilepsy, Seizure disorders
2. Developmental Disorders including delayed speech, motor milestones, and coordination issues
3.Autism and other Behavioural disorders, including attention-deficit/hyperactivity disorder (ADHD), school failure and sleep problems
4. Movement Disorders,
5. Cerebral palsy, muscular dystrophy, and nerve muscle disorders
6. Headaches, including migraines



THANK YOU !